

# WETLAND RESERVATION ON VICTORIA'S NORTHERN PLAINS AND RIVERINE FORESTS

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The depletion and reservation levels of wetlands varied significantly both across the Murray Fans and Victorian Riverina bioregions and in the study area of the Victorian Environmental Assessments Council's River Red Gum Forests Investigation. The proportion of Freshwater Meadows in protected areas was substantially lower than for other wetland types. Furthermore, of the wetlands that are reserved, many were only partially within a protected area. A variety of reserve categories are used to protect wetlands across the three regions, ranging from reserves with high legal protection and a strong focus on biodiversity conservation to reserves with a lower level of protection and emphasis on biodiversity conservation. The findings highlight that many wetlands are incompletely reserved in Victoria's northern plains and riverine forests. The current review of public land use in the River Red Gum Forests, which includes Barmah Forest, should recognise these issues to ensure the effective reservation of wetland ecosystems.

*Keywords:* Reserve design, Riverina, reservation status, conservation planning, Murray River

THE WETLANDS of northern Victoria are a distinctive part of the landscape and include a variety of freshwater and naturally saline ecosystems. These include wetlands that are temporarily inundated during flood events and periods of high rainfall and wetlands with semi-permanent to permanent water regimes (LCC 1983; Margules and Partners Pty Ltd et al. 1990; Butcher & Reid 2002).

The geological and geomorphological characteristics of different biogeographic regions (bioregions) across northern Victoria influence the type, function and ec hydrology of wetlands across the landscape. The Murray Fans bioregion, located along the Murray River between the Ovens River in the east and Narrung in the west (Fig. 1), includes mainly floodplain wetlands, many of which are dominated by River Red Gum *Eucalyptus camaldulensis* and Black Box *E. largiflorens* and were historically inundated during river flood events (Young 2001). Two of the largest wetland areas in the Murray Fans are within the Barmah Forest and Gunbower Forest, both of which are wetlands of international significance under the Ramsar convention. In contrast, the wetlands of the Victorian Riverina bioregion, which covers alluvial plains to the south of the Murray Fans (Fig. 1), supports a differ-

ent range of wetland types including terminal wetlands, saline lakes and freshwater meadows (LCC 1983; State of Victoria 1997).

The classification and mapping of wetlands in Victoria is well developed, but currently without data on ecosystem condition (Spiers & Finlayson 1999, although note recent work by Holmes & Papas 2004). A classification system which delineated wetlands in Victoria based on water regimes and salinity was developed in the early 1980s (Corriek & Norman 1980). This system has been used to classify existing (1994) and pre-European (pre-1788) wetlands within the Victorian Wetland Database (NRE 1996a; DPI & DSE 2004). The wetlands mapping was based on aerial photograph interpretation with different wetland types designed to classify habitat types for waterbirds. Corriek & Norman (1980) acknowledged the pre-1788 mapping was subject to some error, given many drained wetlands may have been difficult to locate. Nonetheless, the Victorian Wetlands Database is widely used in conservation planning in Victoria (e.g. State of Victoria 1997). While Ecological Vegetation Class (EVC) mapping has more recently been carried out across much of the State, the mapping of wetlands has been highly variable in its resolution and is not currently suitable for collating inventories of wetlands

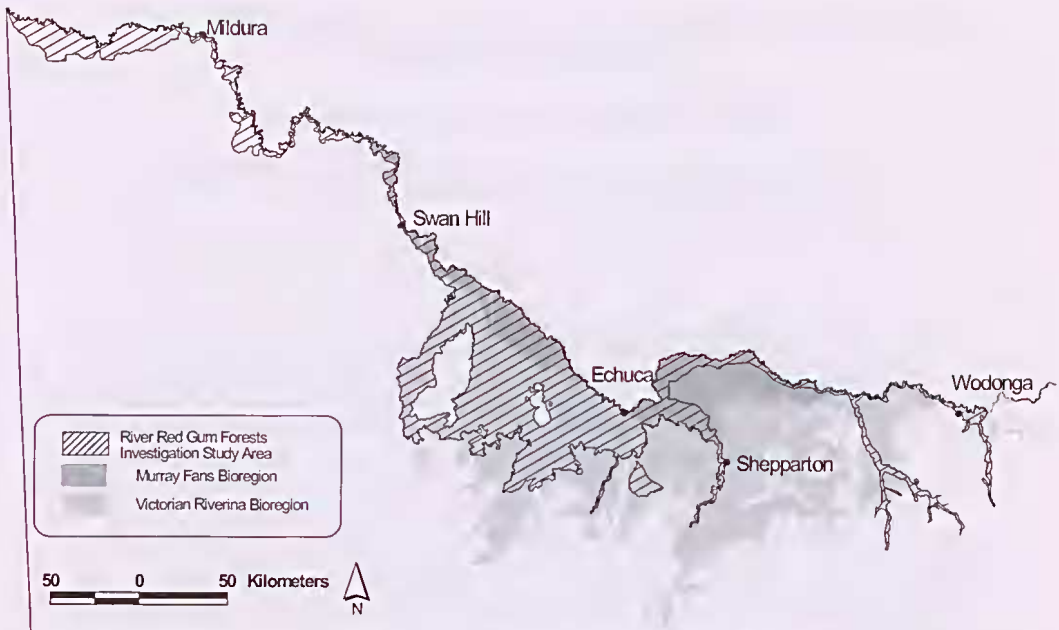


Fig. 1. Location of Murray Fans and Victorian Riverina bioregions and the VEAC River Red Gum Forests Investigation study area.

(Robertson & Fitzsimons 2004). EVC mapping of wetlands has improved in recent mapping exercises in northwest Victoria (White et al. 2003) and the Gunbower and Barmah forests (Doug Froud personal communication).

The establishment of a comprehensive, adequate and representative (CAR) reserve system for the conservation of terrestrial and aquatic ecosystems is a key goal for Commonwealth, State and Territory Governments in Australia. Recent reviews suggest that Australia is currently lacking an adequate freshwater reserve system (e.g. Georges & Cottingham 2001; Nevill & Phillips 2002, 2004). We have previously identified three important indices in the assessment of wetland reservation. These are 1) reservation status (area of different wetland types in reserves, relative to pre-European and current extent); 2) reserve design (percentage of wetland area included in a reserve); and 3) reservation categories (type of reserves which protect wetlands). When assessed at a bioregional level, these indices can potentially make a significant contribution to wetland conservation planning. A study using these measures has previously been undertaken in the Wimmera bioregion in western Victoria (Fitzsimons & Robertson 2003).

The reservation of wetlands in northern Victoria has been established mainly through the recommen-

dations of the Land Conservation Council (LCC) for public land use in the Murray Valley (LCC 1985), Mallee (LCC 1977; LCC 1989) and North East (LCC 1986), and the Environment Conservation Council (ECC) in the Box-Ironbark Forests and Woodlands Investigation (ECC 2001). More recently, a strategic conservation land acquisition program has added a number of important wetlands to the reserve system (Fitzsimons & Ashe 2003; Fitzsimons et al. 2004). Special Protection Zones in State Forest (where timber extraction is not permitted) have also served to increase the area of wetlands managed for conservation (NRE 2002; DSE 2004).

The study area for the recently commenced investigation of public land use in the River Red Gum Forests by the Victorian Environmental Assessment Council (VEAC) encompasses much of the Murray Fans and Victorian Riverina bioregions, with the remainder having recently been studied in the ECC Box-Ironbark Forests and Woodlands Investigation (Fig. 1). The VEAC River Red Gum Forests (RRGF) study area also includes the Robinvale Plains and Murray Scroll Belt bioregions. This paper examines the reservation status, reserve design, and types of reserves protecting wetlands in the Murray Fans and Victorian Riverina bioregions, and within the greater VEAC RRGF Investigation study area. Examining the reser-

vation of wetlands at a bioregional scale and at a regional land use planning scale allows for the identification of biases in the existing reserve system and for prioritisation for increased or improved reservation.

## METHODS

A number of geospatial datasets maintained by the Victorian Department of Sustainability & Environment were analysed within a geographical information system (ArcView GIS 3.3). The datasets utilized were Victorian bioregions (2002), the pre-1788 wetlands, current (1994) wetlands, parks and reserves (as at July 2003), and Special Protection Zones in State Forest (identified in NRE 2002; DSE 2004). All wetland types occurring in the aforementioned regions were assessed (excluding impoundments).

The level of depletion for different wetland types, and the area reserved, within the Murray Fans and Victorian Riverina bioregions and the VEAC RRGF study area were calculated within the GIS. Area calculations were derived for pre-1788, and current (1994) wetlands. The area of different wetland types within protected areas was also calculated. Protected area categories used in this

investigation were those defined by NRE (1996b). Wetland reserve design was evaluated by calculating the proportion of individual wetlands that fall within a protected area. The area of wetlands occurring within various reserve types (including reserves not considered protected areas but excluding Heritage Rivers) was also determined.

## RESULTS

### *Reservation Status*

The depletion of wetlands varied significantly between different wetland types, across the Murray Fans and Victorian Riverina bioregions and the VEAC RRGF study area. Freshwater wetlands, which often have a temporary or intermittent water regime, were the most significantly depleted, particularly the Freshwater Meadow and Shallow Freshwater Marsh categories (Fig. 2). The most significant level of depletion recorded was for Deep Freshwater Marshes and Freshwater Meadows within the Victorian Riverina, reduced to 39% and 42% of their original extent, respectively (Fig 2b). The recorded increase in the area of some wetland

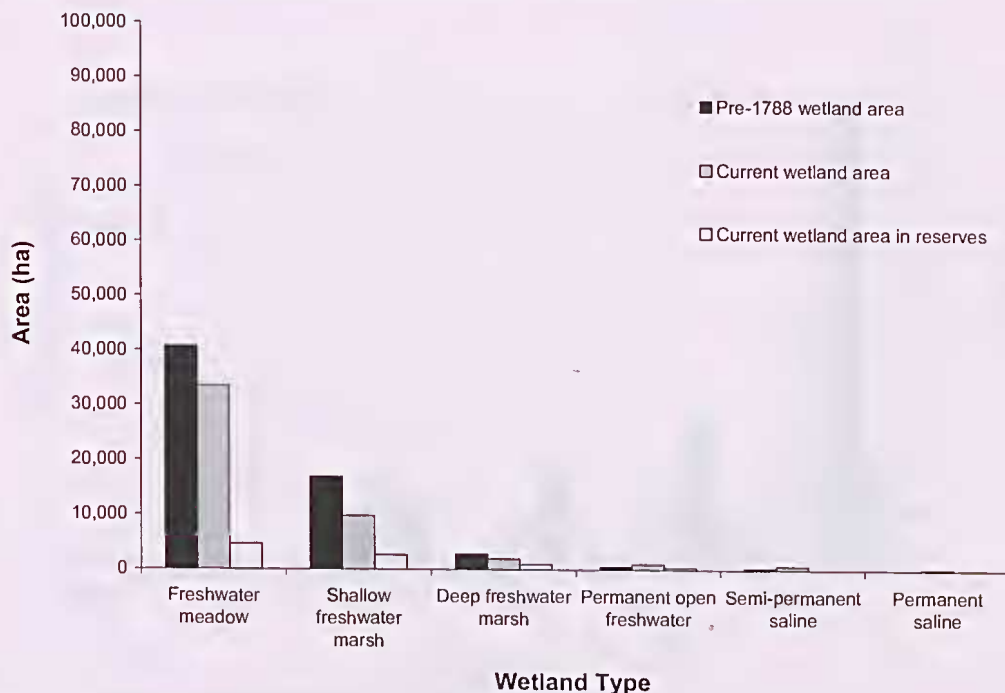


Fig. 2a. Reservation status of wetlands in the Murray Fans bioregion.

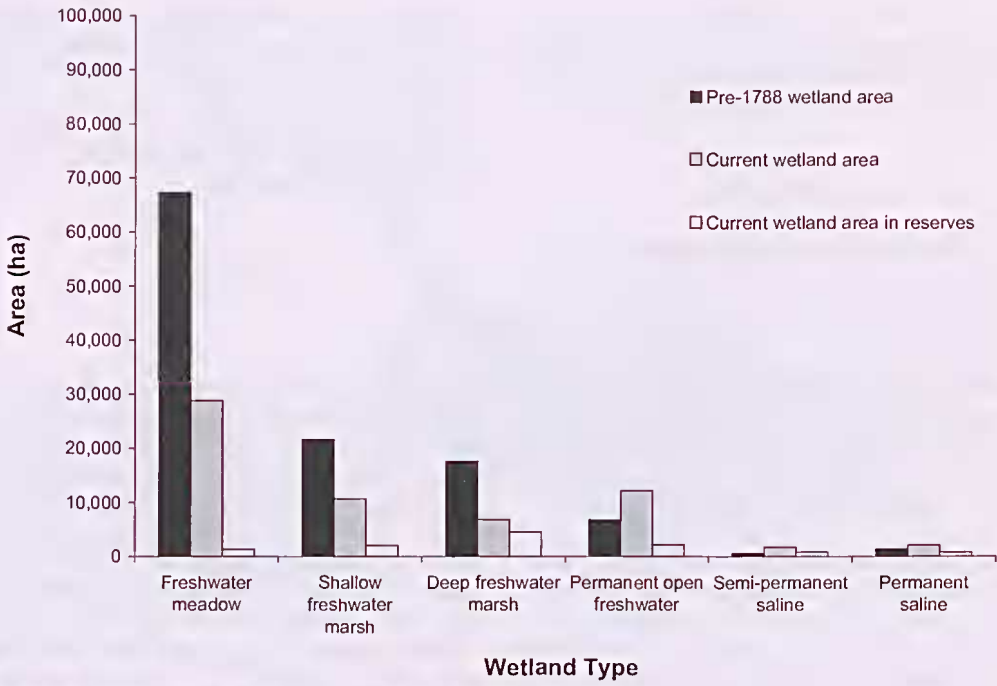


Fig. 2b. Reservation status of wetlands in the Victorian Riverina bioregion.

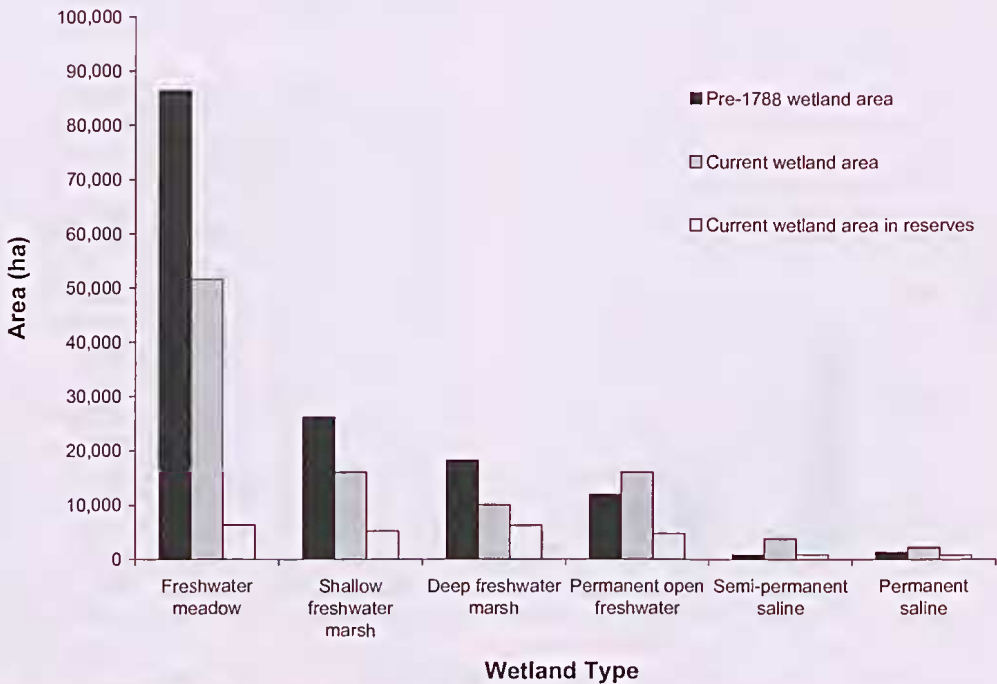


Fig. 2c. Reservation status of wetlands in the VEAC RRGF study area.

types (e.g. Permanent Open Freshwater) is likely to have resulted from the establishment of man-made lakes and other human activities.

The reservation levels of different types of wetlands also differed significantly both within between the three regions studied (Fig. 2). The proportion of Freshwater Meadows represented in protected areas was substantially lower than for other wetland types (11.5%, 1.9% and 7.4% of pre-1788 wetland area for Murray Fans, Victorian Riverina and VEAC RRGF, respectively). At a landscape scale, wetland depletion was greatest and reservation lowest in the Victorian Riverina bioregion (Fig. 2b).

#### Reserve design

Many individual wetlands that have at least some reservation were only partially covered by a protected area. Although many wetlands in the Murray Fans, Victorian Riverina and VEAC RRGF study area had 100% of their area within a protected area, many other wetlands were only partially reserved (Fig. 3). For example, in the Victorian Riverina over 50 wetlands with some form of reservation had less than 20% of their wetland area protected (Fig. 3).

In both the Murray Fans bioregion and VEAC RRGF study area, a larger proportion (38% and 49% respectively) of the reserved wetlands were fully protected (Fig. 3). This is a function of the presence of large reserves which encompass a high number of wetlands in these regions (for example Barmah State Park, Hattah-Kulkyne and Murray-Sunset National Parks). Nonetheless, it is important to note that a number of wetlands have only between 1% and 59% of their area reserved (56 and 142 wetlands for the Murray Fans and VEAC RRGF, respectively).

#### Reserve category

There were significant differences in the categories of reserves which protect wetlands (Fig. 4). Protected wetlands in the Murray Fans bioregions were mostly contained within the Barmah State Park (6,460 ha) (Fig. 4a), although over 1,000 ha of wetlands were also within State Forest Special Protection Zones (SPZ). In the Victorian Riverina, Wildlife Reserves were the most dominant reserve type representing 79% (11,610 ha) of the total wetland area reserved (Fig. 4b). Although there was a much more even spread of wetlands across various reserve

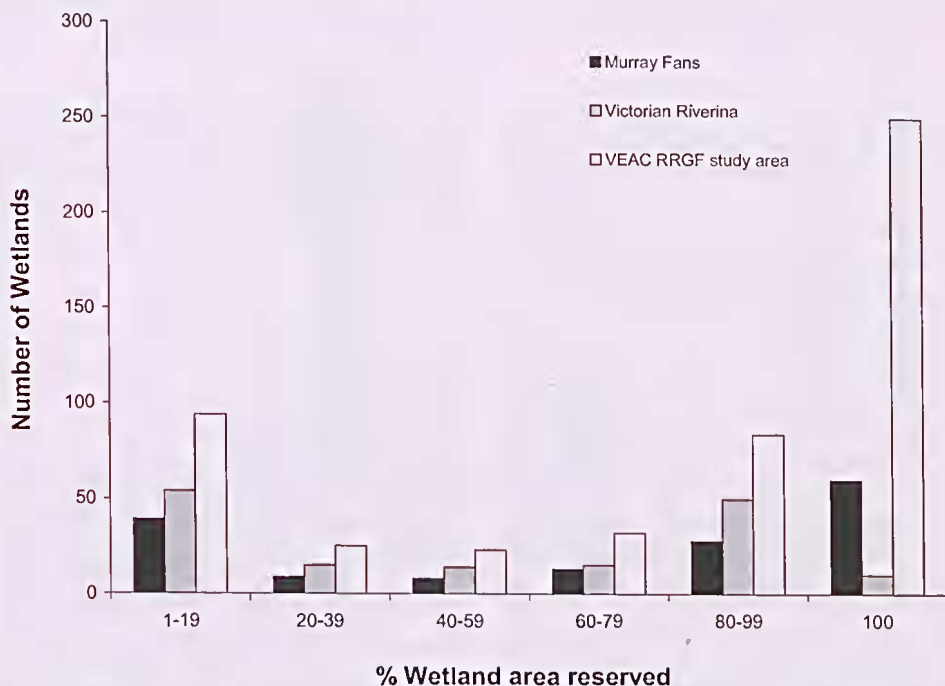


Fig. 3. Number of individual wetlands that have some form of reservation, and percentage of wetland actually reserved in the Murray Fans and Victorian Riverina bioregions VEAC RRGF study area.

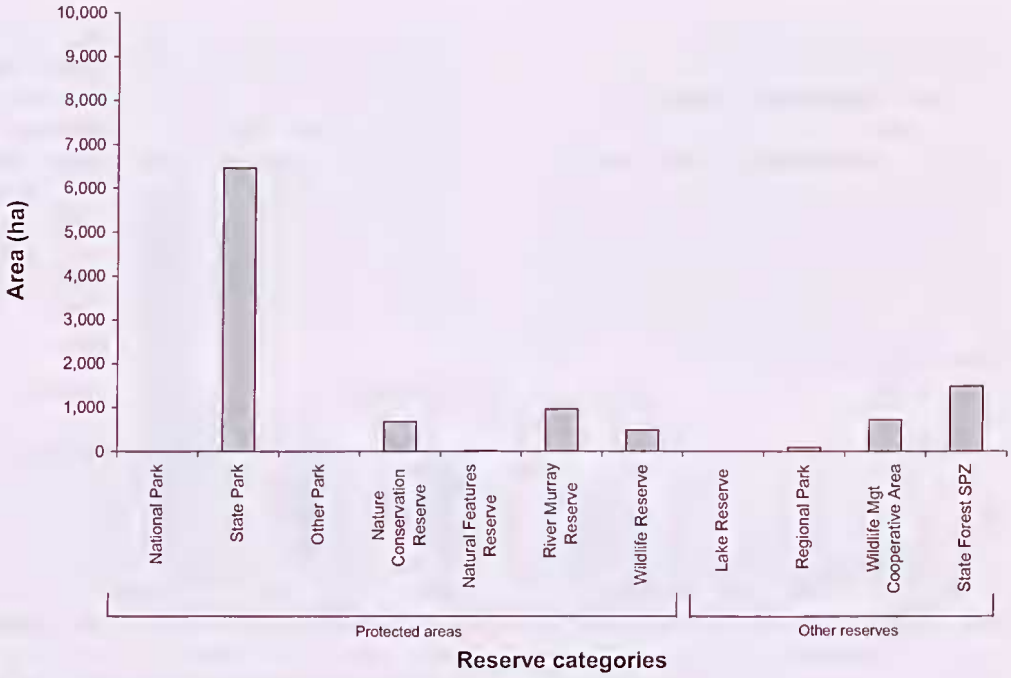


Fig. 4a. Types of reserves protecting wetlands in the Murray Fans bioregion.

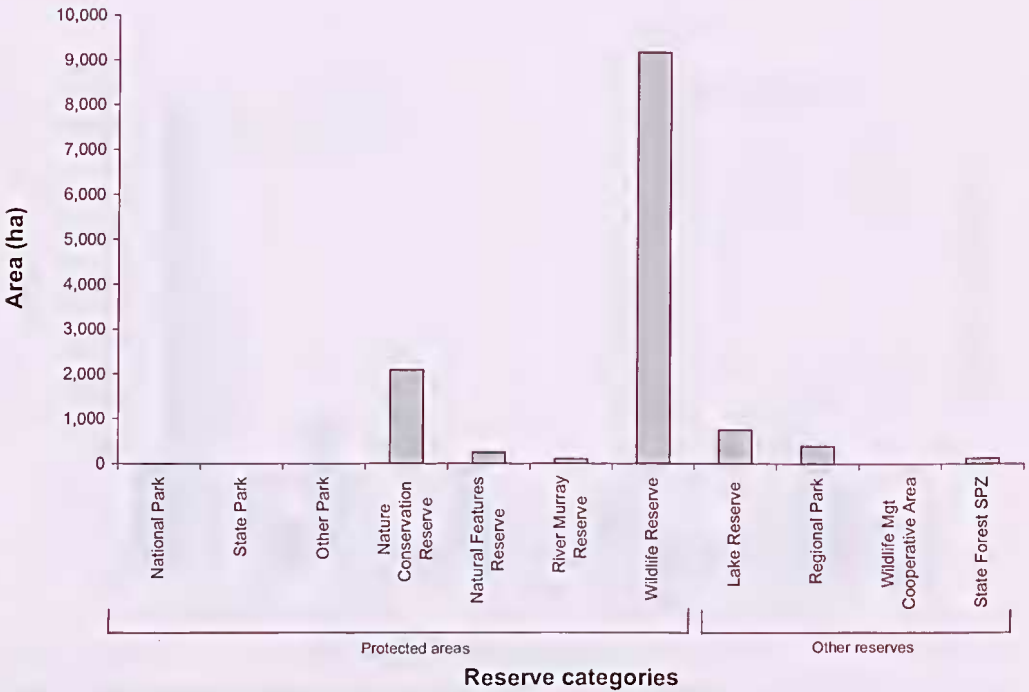


Fig. 4b. Types of reserves protecting wetlands in the Victorian Riverina bioregion.

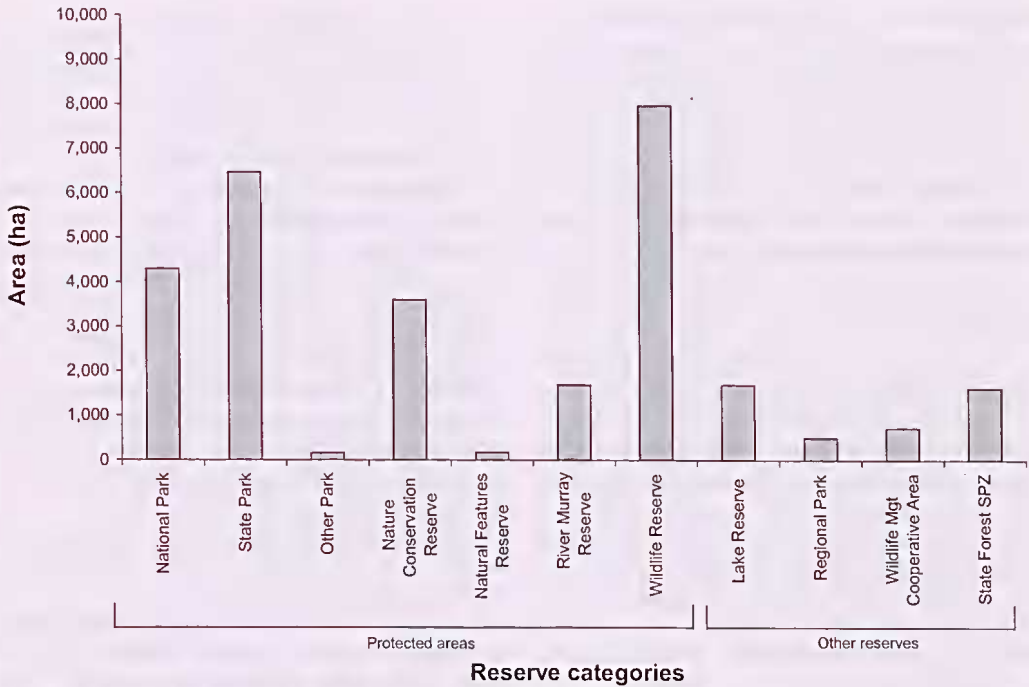


Fig. 4c. Types of reserves protecting wetlands in the VEAC RRGF study area.

[Natural Features Reserve includes Natural Features Reserves, Bushland Reserves and Streamside Reserves. Nature Conservation Reserves include Nature Conservation Reserves, Flora Reserves, Flora and Fauna Reserves and Wildlife Reserves (no hunting). Historic Reserves, Reference Areas (outside of existing protected areas) and Education Areas also include small areas of wetlands.]

categories in the VEAC RRGF study area, including National Parks, State Parks and Nature Conservation Reserves (Fig. 4c), Wildlife Reserves were still the most dominant reserve type protecting wetlands (7,970 ha).

## DISCUSSION

This study has shown the Murray Fans and Victorian Riverina bioregions, which make up a substantial component of the VEAC River Red Gum Forests study area, contain a large area and number of wetland types, particularly temporary and shallow wetland types. However, a number of these wetland types have been significantly depleted since European settlement, such as Freshwater Meadows and Shallow Freshwater Marshes. As these shallow wetlands are often not permanent features on the landscape, and their water regimes are typically episodic, they were more easily converted to agriculture compared to permanently inundated wetlands. While other wet-

land types have not significantly decreased in area since the arrival of Europeans, this may not reflect the quality or functionality of existing wetland systems.

There are also significant biases in the reservation of certain wetland types. For example, Freshwater Meadows are poorly represented in protected areas in the Murray Fans and Victorian Riverina bioregions, and in the VEAC RRGF study area. This is likely to be a direct result of historical land alienation whereby prime agricultural areas (where such meadows once occurred) were converted to freehold title and hence little remained in the public land estate.

Wetland reserve configuration, particularly in the midst of flat agriculturally productive areas (i.e. the Victorian Riverina) has often been predetermined by subdivision of the landscape. The resultant reserve 'shapes' are often square or rectangular. As a consequence, the reserve configuration often does not relate to natural drainage characteristics or the boundary of the ecosystem that such reserves are

supposed to protect (Fitzsimons & Robertson 2005). We have previously noted that reserve design is of critical importance for the conservation of wetlands due to the interconnectedness of hydrological and ecological attributes across individual wetlands and the surrounding landscape. By only reserving a portion or even most of a wetland, it is likely that degrading processes occurring in unprotected areas will ultimately impact on the reserved portion of the wetland (Fitzsimons & Robertson 2003). In the three different regions assessed in this study, it was found that many wetlands were incompletely reserved in protected areas, particularly in the Victorian Riverina bioregion.

However, many wetlands, even if they are not fully protected, are effectively buffered by surrounding uncleared public land. This may include State Forest, unused road reserves, or other uncategorised public land. These areas of public land may provide an important buffer of native vegetation, which reduces threats to wetland ecological processes. Such assessments are directly relevant to the current VEAC River Red Gum Forests Investigation into public land use.

Consideration of the management objectives and protection mechanisms for protected areas and other reserves is also important when assessing reservation status for wetlands, as not all reserves have the same management priorities, levels of legal security or funding (Fitzsimons & Robertson 2003, 2005). Wetlands were protected within a variety of reserve categories across the three regions, including those with high legal protection and a strong focus on biodiversity conservation (National Parks, State Parks and Nature Conservation Reserves) to those with a lower level of protection, management or emphasis on biodiversity conservation (e.g. Wildlife Reserves).

State Park was the dominant reserve category for wetlands in the Murray Fans, which reflects the relatively large area within Barmah State Park. Interestingly, SPZs in State Forest (mainly Barmah and Gunbower), which are not considered protected areas, represented the second highest area 'protected' in the Murray Fans. Wetlands in the Victorian Riverina, which had higher depletion levels, were predominantly reserved within Wildlife Reserves. Wildlife Reserves (State Game Reserves) allow hunting of selected game species and, in some wetlands, grazing. Within the VEAC RRGF study area, wetlands were much more evenly spread between the various reserve categories.

Wetland occurrence on lesser protected reserves such as SPZs and Wildlife Reserves highlight areas where immediate improvements to the wetland reserve system could be made (e.g. potentially 'upgrading' these areas to Nature Conservation Reserves or National or State Parks).

There are also a number of internationally important Ramsar wetlands in northern Victoria (e.g. Hattah-Kulkyne Lakes, Barmah Forest, Gunbower Forest, Kerang Wetlands). These Ramsar sites (which are not considered protected areas in their own right) include a variety of land tenures, some of which are protected areas and some are not. It is also interesting to note that Ramsar site boundaries vary from encompassing all public land within a wetland system (Barmah Forest and Gunbower Forest), to individual wetlands in the midst of public land (Hattah-Kulkyne Lakes).

One of the terms of reference for the VEAC RRGF Investigation is to take into consideration nationally agreed criteria for reserve system establishment (e.g. JANIS 1997; NRMCC 2005), which includes meeting comprehensiveness, adequacy and representativeness objectives. Reinvestigating the reservation status, reserve design and relative protection of wetlands in northern Victoria following the completion of the VEAC investigation would be worthwhile to determine if this process results in any improvements to wetland reservation.

The VEAC investigation will be limited to assessments of existing public land. Considering many of the remaining wetlands are located on private land, conservation mechanisms will need to be broader than reservation on public land alone. Although this study focuses on Victoria, it is important to recognise that riverine forests (e.g. Millewa Forest) and alluvial plains also occur to the north in NSW. Similar studies of wetlands in both of these areas would enable a more comprehensive understanding of wetland reservation issues across the broader landscape.

Considering the water regime of wetlands in northern Victoria, such as those in Barmah Forest, fluctuates widely depending on flood events in the Murray River and other tributaries and on regional climatic conditions, conservation planning must also take into consideration the spatial and temporal variability of these wetland systems. Ultimately, management of water regimes, including environmental water allocations, may be more important for the biodiversity of the wetlands than reservation itself.



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